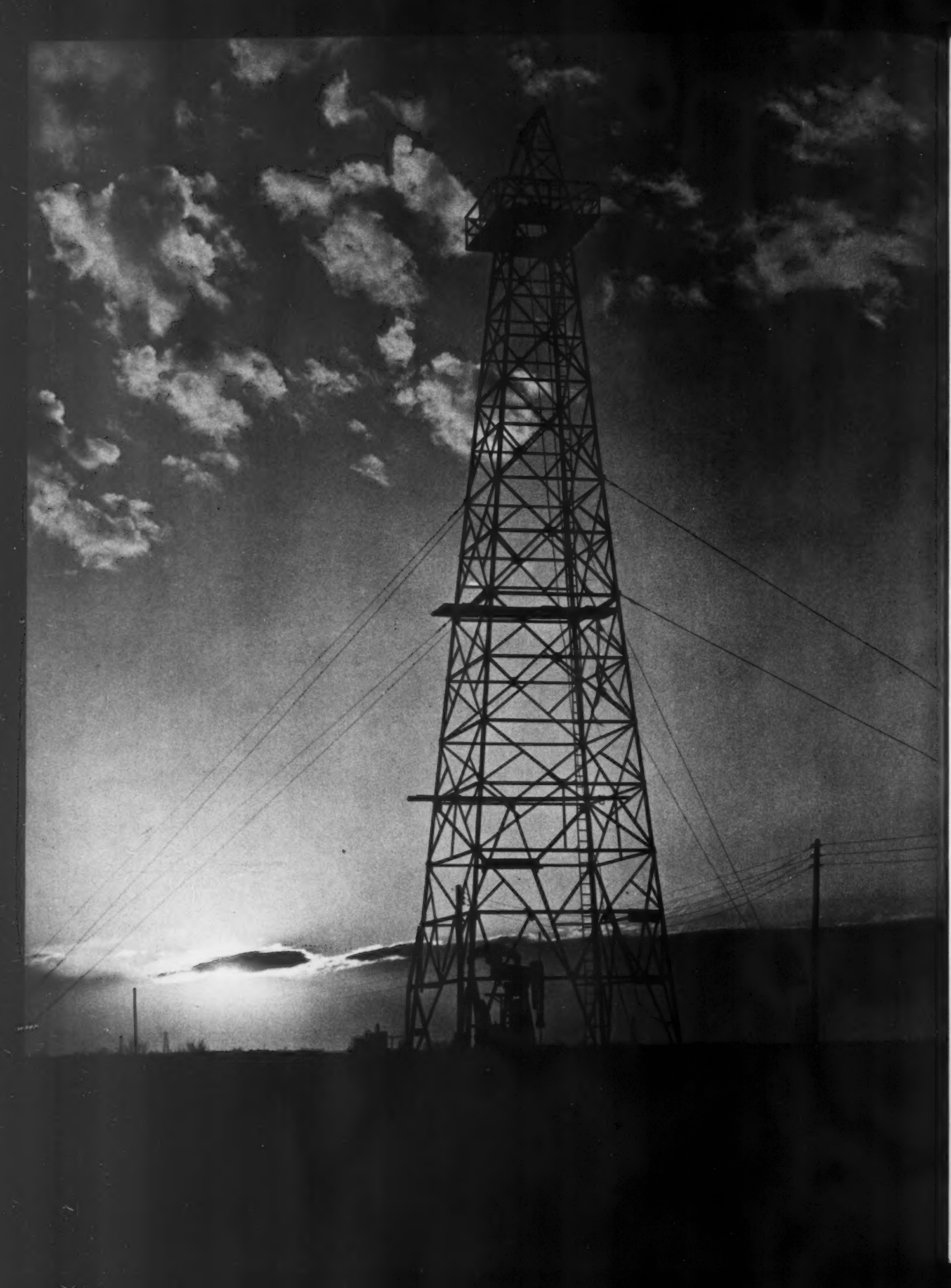
Stagecoach Stop at Hueco Tanks — *Bob Wygant*

The Humble Way

SEPTEMBER-OCTOBER, 1956



The Humble Way
September-October, 1956
Volume XII No. 3

RIBBONS OF BLACK ACROSS THE NATION

New highway program emphasizes important part asphalt continues to play in America's transportation system

DURING the next 13 years the biggest road building project in world history will be undertaken in this country. Mammoth machines will gouge out, fill, and fashion 750,000 miles of smooth traffic arteries across the face of the land, and if established building patterns hold true an estimated 75 per cent of these smooth miles will be ribbons of black—modern asphalt roads.

To link together every major city and area in the 48 states, the program calls for building 41,000 miles of new interstate superhighways, 200,000 miles of state highways, and 508,000 miles of rural roads.

Total cost of the project, some $50 billion.

This prodigious effort is calculated to eliminate, or at least reduce, traffic jams and danger spots for millions of Americans on vacations, weekend drives, or business trips. Fewer auto accidents and greater driving comfort are additional benefits Americans hope to gain from this road system engineered for modern driving.

Engineers and road builders today, as they have for the past half century, look to asphalt as their Number 1 construction material. Approximately 750,000 of the 920,000 miles of all paved roads in use today—four out of every five miles—are asphalt roads. There should be little cause, then, for surprise at any estimates which indicate that at least three out of every four miles of the huge new network will come from the same black substance.

The two words "roads" and "asphalt," indeed, have almost become synonymous during the past 50 years.

One of the prime reasons for this, thanks to the American petroleum industry, has been the availability of asphalt at reasonable prices through the years.

When asphalt roads first came into vogue in the 19th Century in Europe and the United States, rock asphalt came from deposits in Europe and natural asphalt from lakes on Trinidad Island. These sources adequately met the small demand of the time, but when the automobile came into common usage, the demand for paved roads and asphalt skyrocketed. The Trinidad lakes and asphalt rocks of Europe simply couldn't keep pace. It was then that contractors looked hopefully to the American petroleum industry for help. The industry responded and now practically all asphalt in the United States is carefully refined from crude oil.

Production of asphalt soared from about one million tons 35 years ago to more than 17 million tons last year—and will reach an estimated 19 million tons this year.

Humble has played its part by increasing asphalt production more than 100 fold during the last 20 years at

Sunset in this West Texas oil field brings every piece of the derrick into silhouette. Note guy wires to guard against winds which often sweep across the unprotected plains.

Construction of asphalt road makes maximum use of native materials—sand, stone, slag, gravel—obtained by local contractors. Road is built in continuous ribbon.

Baytown Refinery. The Company produced its first commercial asphalt in 1938—714 barrels—for paving a rural road south of Houston. Since then, production has zoomed to 2,000 barrels a day—enough to pave 15 miles of farm-to-market roads.

The development and improvement of modern asphalt road building techniques is another significant factor in the growth of our vast network of asphalt roads.

Remember the chug holes you used to whomp into while motoring over country lanes? Or the high-pitched tune your tires played as you drove over asphalt roads softening under the hot sun? Or the corduroy bumps which jarred the radiator cap loose as you quivered along?

Today's road engineers and constructors have improved their methods so roadways are less apt to fail. Through careful gradation, builders now can fit the rock, sand and other materials together compactly into foundations in which aggregate particles will not roll over each other, corduroying into wavy bumps. Also, they have learned that too much asphalt—as well as too little—is bad business. Too much on a road surface will melt in the hot sun and cause slickness in wet weather. Too little asphalt won't bind together properly the particles of aggregate.

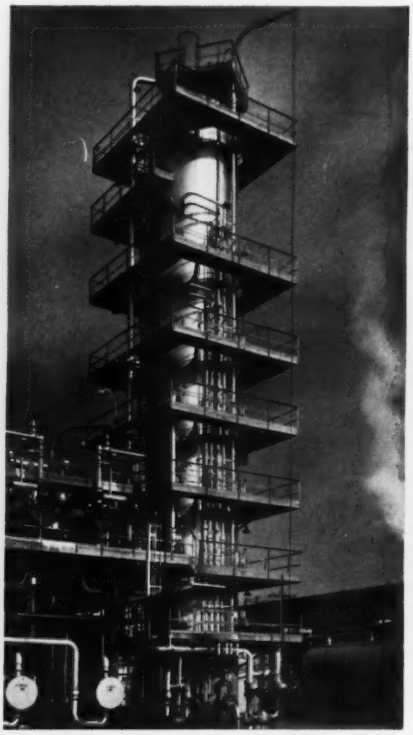
Although asphalt road builders have made great progress in recent years, the basic principle which governs their construction today dates back to an early-day Scotsman, John Loudon McAdam, who gave the "macadam" road its name.

In 1823 he thundered out his theory to the London Board of Agriculture: "It is the native soil that carries the load," he argued. "If that can be kept dry and stable, all you need for a surface is a waterproof layer of broken stone."

The only significant change since then is the introduction of asphalt as the cementing material, an all-weather

MAKING ASPHALT AT BAYTOWN

In pipe stills like this, crude oil is first separated into its various fractions by distillation. The low boiling point products such as gasoline, kerosene, and Diesel fuels vaporize when heated and are drawn off, leaving a heavy residue containing asphalt.



At Propane Lube Plant asphaltic residue flowing from the pipe still is further refined and the asphalt is recovered.

binder, and a wider variety of "aggregate"—crushed rock, slag, gravel and sand.

If you can visualize the cross section of a typical heavy-duty asphalt road, you probably would note four distinct layers. At the bottom would be the native soil, on top of which would be a layer of crushed rock, gravel or other select subbase. Next in line would be another layer of smaller crushed rock or gravel, penetrated with asphalt. And on top of that would be the top layer of asphalt pavement—from two to six inches thick. With such a dissection, it would be easy to see that at no time does the asphalt in an asphalt road carry the weight of the traffic. Instead, it binds together and waterproofs the materials which actually do the work.

Each layer of the road maintains constant contact with the one above and below it, pyramiding the heavy wheel loads down through the other layers to the native earth.

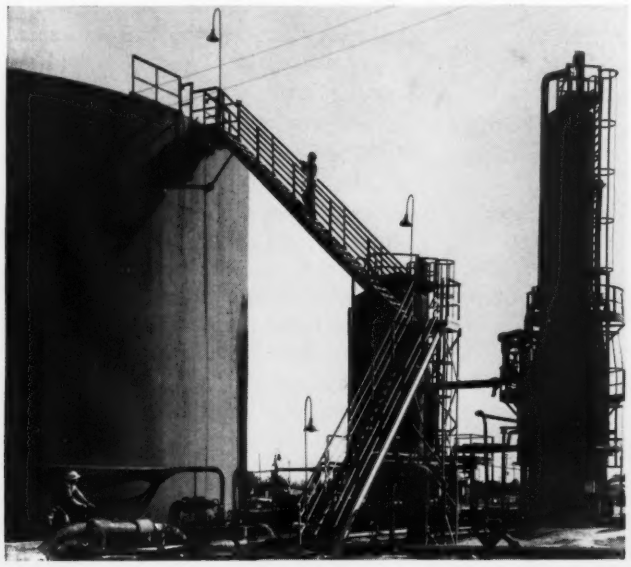
Engineers, motorists and taxpayers through the years have liked asphalt roads for several big reasons. And one of the primary ones is economy—of original investment and of maintenance.

City streets are paved generally with asphalt. When repairs or resurfacing are needed on busy thoroughfares, traffic can be diverted temporarily to one lane.

On an asphalt road, contractors make maximum use of local materials in the sub-structure at considerable saving. Smaller amounts of relatively expensive overlying materials are used that have to be transported to the construction site. Also, costly expansion or contraction joints and steel reinforcing are not needed.

And when an asphalt road begins to show signs of wear, a light surface treatment with more low-cost asphalt will restore it to better-than-new condition.

Long life under heavy traffic loads is another popular feature of asphalt roads. An asphalt pavement "gives" under traffic, absorbing the shock of heavy wheel loads and passing the strain down and spreading it out through the successive layers to the



For final processing, the asphalt flows by pipe to the Asphalt Plant, where eight different grades are mixed in giant tanks.

Asphalt samples are tested in the Refinery Research laboratories. If sample meets Humble's specifications, a seal is clamped on the tank. The Texas Highway Department then runs similar tests, and if the asphalt also meets their "specs," the batch is approved officially for use on state roads.

Insulated tank trucks, at right, transport most of the asphalt from Baytown Refinery, delivering it directly to road construction sites. Night loading is most popular, as this enables trucks to reach their destinations by early morning—in time for the normal work day—while their cargoes are still hot.

Superhighways paved with asphalt are integral part of interstate road network. Such transportation arteries mean safer, easier driving for millions of motorists.

Asphalt paved rural roads like this one in Texas are helping America's farmers and ranchers speed their products to markets quickly in all types of weather.

native earth. Whenever the earth settles after construction—as it almost always does—the flexible asphalt surface follows the settlement, creating a gentle dip in the pavement instead of a crack. The dip, then, can be easily and economically corrected by resurfacing.

Still another big advantage of asphalt roads is the fact they can be built up, stage by stage, to meet changing traffic patterns, retaining the original investment in many instances.

Asphalt roads also are noted for their smooth riding qualities and safeness.

What can the average motorist expect from asphalt in the future?

The answer to this one is easy—better, smoother, tougher and more economical roads. Such progress is insured in part by a continuing research program in laboratories throughout the country.

One of the most recent developments in asphalt roads—and one which promises to become widely used in the years ahead—is envelope construction. First, the surface is graded and built up like any other asphalt road base. Then a light coat of asphalt is applied, followed by a layer of soil. Next comes another light coat of asphalt. Thus, the soil is sealed in by asphalt at top, bottom and sides. Over this envelope of soil is laid the regular asphalt pavement.

The envelope of soil retains its moisture, does not give way and settle, leading to pavement holes or dips.

Roads paved with asphalt-rubber combinations also have been developed and placed into operation in several cities around the country. But due to its newness, no significant conclusions have been drawn on this road type to date.

From test tube row recently has come a new quick-drying asphalt. It is an emulsion of asphalt and water and after being laid on a roadway, quickly loses the water and dries into a hard, tough surface.

In laboratories everywhere—like Humble's at Baytown—continual research is making possible new types of asphaltic aggregates and new techniques for using them—all with the end goal in mind of making our ribbons of black better, cheaper, and more economical for you—America's motoring public.

Football at your Fingertips

Pencil poised over ear, Kern Tips pensively watches Baylor, Tech warm up.

Humble television and radio crews use heads-up planning not unlike the teamwork in Southwest Conference games they report

IT'S SATURDAY afternoon and you are manipulating the dials of your television set. A familiar face appears on the screen, and a familiar voice begins:

"Good afternoon. I'm Kern Tips, welcoming you to the live telecast of the Baylor-Texas Tech game from Baylor Stadium in Waco. I'm speaking for your host, the Humble Dealer in your neighborhood."

"Whatta gravy train those sports announcers have," you mutter to yourself; "getting paid just to *watch* football games."

* * *

If you could but know the hair pulling problems involved in producing a football telecast, you would be impressed, if not awed, that the show comes off at all. And you'd figure whatever those announcers and their helpers get paid, it isn't enough.

Planning for this telecast began months ago. Even last summer when most fans were speculating as to whether Cincinnati could win the National League pennant, Humble was busily preparing for the 70 radio broadcasts and six regional telecasts scheduled on its networks during the 1956 Southwest Conference season.

In August, more than 30 play-by-play announcers, color announcers, and supervisors (one of each, plus two spotters and an engineer, make up a team) met in Houston to review the techniques of the Humble broadcast, to study changes in game rules and to re-accustom themselves to patterns of football offense and defense.

As the season got underway, the broadcast teams began to get the old football feeling, working out the kinks in their routines. Concentration on the Baylor-Texas Tech telecast intensified during the week preceding the game. For days, Kern Tips studied the Baylor and Tech teams, their rosters, their coaches, methods of attack and defense, and the history of the series. At night, he kept at his "home work," ferreting out and storing up nuggets of information about the Bears and the Red Raiders.

Color announcer Alec Chesser, who has worked with Tips for almost half of Tips' 22 years as Humble sports announcer, was nugget-hunting all week, too. He searched his files for facts on school anthems, traditions, mascots, band personnel and history.

Come along now to Baylor Stadium for a behind-the-scenes look at how these Humble crews use teamwork rivaling that on any football field to produce a satin-smooth football telecast.

The gridiron is still shaded at 10

Silhouetted against gridiron, one of three TV camera crews zero in on play as game gets underway. They are in constant contact with engineers in truck below stadium.

a.m., when you arrive with Tips, Chesser, and TV supervisor Gene Heard. An elevator takes you up to the pressbox, sitting like a giant eyebrow on the rim of the bowl.

On your way to the Humble telecast booth, you notice that all the television equipment already is in position. Tips opens his two briefcases and sets up housekeeping for the game. He places two cups of water near his microphone, and begins to tack up the "ad lib" cards he will use to fill time-outs and game lulls.

CHESSER, meanwhile, gets an official time check from an engineer, then phones the Waco weather bureau for a late forecast. Tips ambles off to hunt the sports publicity men of Baylor and Texas Tech. He'll want last-minute information about injuries, changes in probable starting lineups, and other late developments.

Three hours before air time, Chesser is pecking away at his portable typewriter, writing halftime copy. Earlier this morning, he talked to the Baylor and Texas Tech band directors about what to expect before the game and at halftime. He'll have to fill 10 minutes before the game, 15 minutes at halftime, and a final five-minute wrap-up.

Years of broadcasting experience has taught Humble color men the value of preparing for the worst. Once, for example, a color announcer had to "fill mike" 45 minutes when a train bearing a team was late, delaying the kickoff. Another pre-game commentary ran 30 minutes. Reason: An airplane, scheduled to fly over the stadium and drop the game ball, missed the field by a good mile.

Such mishaps have put plenty of gray hairs in the heads of supervisors like Gene Heard, the man responsible for seeing that everything goes well at telecasts. He must be ready for such emergencies as once occurred during a radio broadcast under Rice Stadium's arcs. Due to a power failure, the lights on the field—and in the pressbox—went out. The alert supervisor had his flashlight, however, and the Humble color man filled time until the trouble was located.

If the supervisor is handy before a game, he's downright indispensable come air time. Take our telecast for example. Heard is the contact man with the engineers in the television truck under the stands. He gives cues on cutouts for advertisements, listens on a headset to check exactly what the folks at home are hearing. He keeps tab on scores of other games by portable radio. He may serve as waterboy for the announcers or fend off trespassers from the telecast booth, but he's the captain of the team.

Two hours before air time, Tips begins to work up a minor case of butterflies, which he considers important to a sports announcer. Seated on six cushions to elevate him above his small TV monitor and Grid-Graph, he chews gum nervously and taps out rhythm to the music issuing from the radio behind him. He stares with preoccupation at the empty stadium. Without provocation, he may grab a starting lineup and read rapidly in his husky, clear-cut drawl—shadow-boxing verbally.

Meanwhile, three television cameras, set up hours ago, now send test images to their monitors in the engineer's truck. During the game, the engineer will constantly choose one of the three scenes to channel into your living room. Out on the field sideline, an engineer's assistant sets up a parabolic mike which will pick up band music and crowd noises. An engineer can make or break a broadcast. And like the supervisor, he comes prepared for any emeregncy. A duplicate set of transmitting equipment stands ready; should power failure occur, he can operate on batteries.

Thirty minutes prior to the kickoff at 2 p.m., the Baylor and Texas Tech spotters arrive and get instructions on where they will sit, what is expected of them, and how to operate Grid-Graph, the spotting device built to Tips' specifications.

These spotters are students who have an easy familiarity with their squads. A memorable one of the past was a halfback, out with a broken leg. He was big, the radio booth was small and the only place for his cast-encased leg was in Kern's lap. "That wasn't so bad," the popular sportscaster recalls, "but he was a punter. With every punt onfield, he reflexed. That plaster cast had me black and blue before the final whistle."

A few minutes before air time at 1:45 p.m., Tips walks into a nearby booth to face a camera and open the telecast. Then the mike is switched back to Chesser, who handles verbal chores until kickoff time, 15 minutes away.

RETURNING to the main booth, Tips nestles down on his cushions and waits. Comes the kickoff and Kern is away, telling the story of the game at the rate of 200 colorful words

a minute. At that rate, he speaks about 600,000 sports words a season—that's about the equivalent of the long novel "War and Peace." Tips' 22-year total would probably top 13 million words.

Television is tougher for the play-by-play announcer than radio. On radio, he often is hard put to watch 22 players, four or more officials, his spotting apparatus and the time clock. Add to that a small TV monitor (to show precisely what the fans at home are seeing) and you get a picture of where Kern Tips' eyes are during a telecast. Television requires fewer words since the viewer sees almost as much as the sportscaster. But besides that and mechanical complexity for the engineers, there's little difference between radio and TV football broadcasting.

Tips, who still works both mediums, is as professional as a surgeon performing a delicate operation as he dissects each play. In the Southwest, he sits at the head of the class as a student of football. On the air, he combines the communicative ability of a country editor with the polish of a big city reporter. He has a keen sense of the whimsical; the exodus of a dog from the gridiron may be described like this: "Fido gains running room, evades one official, runs between the legs of another, and breaks into the clear. He's across the 10, the 5; he's over for the touchdown—and off the field."

While Tips reports the game, color man Chesser is, as he puts it, "busy as a cranberry merchant." With a special slide rule he invented himself, he keeps the position of the ball and is able to compute running, passing, punting yardage at a glance. On a miniature scoreboard high to his left (where Tips can see it), he keeps track of first downs and other statistics.

While Tips and Chesser are holding forth in television concert, fellow Humble announcers are broadcasting games by radio in far-flung cities around the state and nation. Play-by-play men include Ves Box, Eddie Barker and Jerry Doggett, all of Dallas; Dave Russell of Beaumont, Bob Walker of Wichita Falls, Connie Alexander of Albuquerque, and John Phaelan and Ted Quillan of El Paso. Color announcers are Dave Smith of Austin, Mike Mistovich of Bryan, Jack Dale of Lubbock, Eddie Hill of Dallas and Jim Wiggins of San Antonio. All are ace sportscasters in addition to other duties; many have followings to rival that of Tips. One, Jerry Doggett, has been signed to broadcast the Brooklyn Dodgers' baseball games next year.

Eight-man line of Humble announcers and spotters include Color-man Chesser and Tips (between spotters) on TV; in far booth, Barker, Wiggins handle radio duties.

HUMBLE announcers are a carefully selected group. Some exceptional skills are required and nothing is taken for granted. They must know the teams, the records, the signals, and above all, respect the province of the officials. Individual style is encouraged, but Humble announcers strive first to present a strictly unbiased account of the game in the manner of an "articulate spectator." They describe, never editorialize. These veterans are enthusiastic, but they let the listener turn his own cartwheels. Great football games, not great sports announcers—that's their goal.

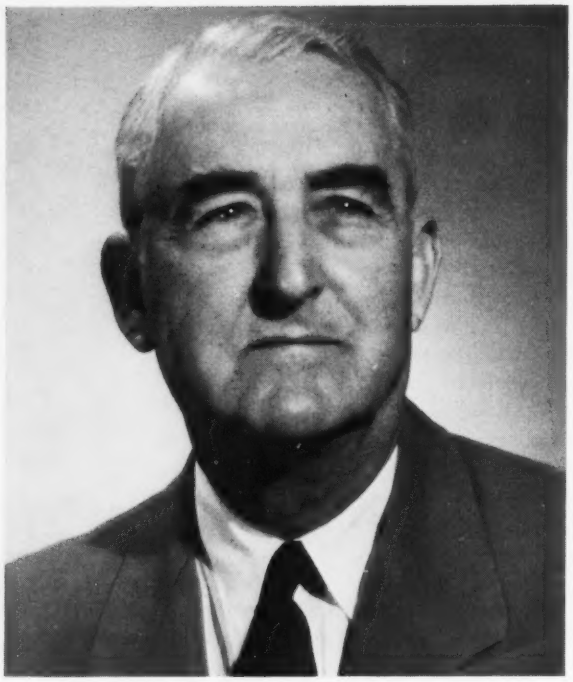
Announcers for Humble abide by one of the most unusual broadcast codes in the country. These rules are founded on the recognition that the pressbox is a long way from the field of play. Therefore, in the eyes of a Humble announcer, no individual player is guilty of a foul. Teams, not players, are penalized. A linebacker seldom "misses a tackle;" generally, he is "taken out of play by a key block." An end never "mishandles" a long pass; it is "too tall for him." No one is "knocked out" or "severely hurt" or "carried from the field." On injuries, players are "shaken up." This thoughtful policy has been lauded time and again by grateful parents in the radio audience.

The injury rule came in for off-the-field application some years ago when an end zone bleacher gave way, dumped hundreds of people to the ground and hurt 34 of them. In order to spare at-home friends and relatives worry and concern, the incident was not reported on the Humble network. Ignored, too, are riots, fisticuffs—anything, in fact, incidental to action on the field of play. It's Humble's way and it has proved to be a good way for Humble broadcasts over 23 years.

Able as they are, Humble sports announcers make mistakes. And they admit them freely on the air—be it a mispronounced name, a miscredited tackle, an inaccurate yardage. Kern Tips, who's made more than a few miscues himself, likes to credit himself with opening a broadcast: "Good evening, Kern Tips; this is ladies and gentlemen speaking." But every sports announcer, he says, tells the same story on himself. For every announcer occasionally pulls a monumental fluff.

"It's a shame," says Tips, "that we don't have erasers on our mikes."

REX G. BAKER RETIRES



Rex G. Baker

REX G. BAKER, Vice President and General Counsel, retired August 29 after 36 years of active service with the Company.

Mr. Baker was born in 1891 in Mills County, Texas, and grew up in Medina. He received bachelor of arts and bachelor of laws degrees from The University of Texas in 1917, and was elected to Phi Beta Kappa; Chancellors, honorary law society; and Friars, honorary academic society.

The young law graduate wasted no time in exchanging his academic cap and gown for a suit of khaki. Receiving his commission as second lieutenant at the first Officers Training School at Leon Springs near San Antonio, Mr. Baker served in the army for two years. He was discharged in 1919 with the rank of captain.

After his discharge from the army, he went into law practice in Beaumont. He joined Humble's Law Department in 1920.

During the period of Humble's greatest expansion, in the late 1920's and 1930's, Mr. Baker was in active charge of legal work involved in the acquisition of leases. During his long and productive career he has handled legal matters for every department of both Humble Oil & Refining Company and Humble Pipe Line Company, giving much of his time to the solution of conservation problems. It was through extensive experience and skill in legal matters as related to the oil industry that he rose, through positions of increasing importance, to the high office he held at the time of his retirement.

In addition to his services in the Law Department, Mr. Baker was elected a director of Humble Pipe Line Company in 1929. He held this position until 1943, when he was elected a director and General Counsel for Humble Oil & Refining Company. He thus became legal adviser of the Humble Companies, responsible for the operation of the Law Department, the land records and rentals division, the claim and right-of-way division, and the ad valorem tax division.

In addition to these responsibilities, Mr. Baker served as a director of Petroleum Casualty Company, the organization which carries workmen's compensation insurance for the Humble Companies. He was also a trustee of the thrift fund of Humble's Annuity and Thrift Plan.

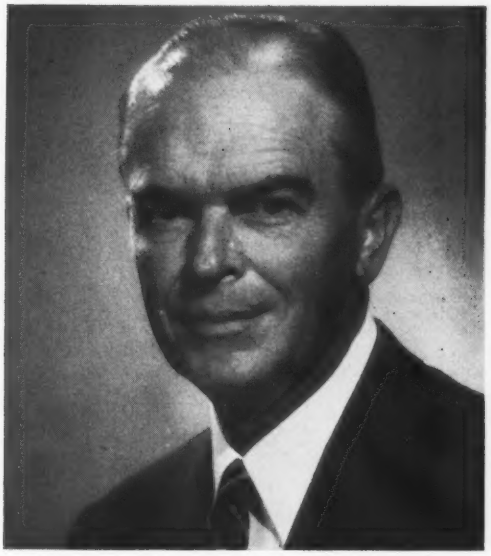
Mr. Baker married Miss Edna Heflin of Austin in 1917. They have four children: Robert H. Baker, who is in the oil business; Rex G. Baker, Jr., an attorney and banker; John H. Baker, in the manufacturing business; and Mrs. George N. Harris. All are married and live in Houston. Mr. Baker has 12 grandchildren. He and his wife live at 3671 Inwood Drive in Houston.

Active participation in church and civic work and in professional associations has been a part of Mr. Baker's 36 years in Houston. For many years he was a leader in South Main Baptist Church affairs; until recently he was chairman of the deacons at River Oaks Baptist Church, and he still teaches a Sunday School class there. He is a member of the Houston Bar Association, State Bar of Texas, the American Bar Association, the American Law Institute, Mid-Continent Oil & Gas Association, and the American Petroleum Institute.

Local organizations which have claimed his interest and attention include the Community Chest and United Fund, the Y.M.C.A., and the South Texas School of Law. He was elected a director of the Houston Chamber of Commerce in 1955 for a three-year term, and serves on the Natural Resources Committee of the United States Chamber of Commerce.

When he can take time off from his business and civic duties—and these will be considerable, even in retirement—Mr. Baker finds relaxation in shooting an occasional round of golf.

Nelson Jones New Director and General Counsel



Nelson Jones

NELSON JONES, Humble's General Attorney since 1948, was elected to succeed Rex G. Baker as a member of the Board of Directors and General Counsel.

Mr. Jones was born in 1909 in Quitman and attended schools in Mineola. In 1929 he received a bachelor of arts degree from Southern Methodist University. He was graduated from the University of Texas Law School in 1933 and holds membership in Phi Delta Phi, honorary law fraternity.

The year he received his law degree, Mr. Jones went to Conroe as assistant district attorney for the Ninth Judicial District. He served in that office until 1937, when he began work in Humble's Law Department.

Assigned to the trial division, Mr. Jones tried cases and also worked on Humble Pipe Line Company's legal matters. In addition to his services in the Law Department, he became a member of the board of directors of Humble Pipe Line Company in 1943. For the next five years he handled most of Humble's problems arising from government regulations.

In 1948 Mr. Jones was named a vice president of Humble Pipe Line Company, a position created because of the growing complexity of the regulations. He continued to do the same work, however, until later in that year, when he became General Attorney for the Humble Companies. In that capacity he became head of the trial division.

Mr. Jones is a member of the St. Francis Episcopal Church and the Forest Club. His affiliation with professional associations includes membership in the Houston Bar Association, the State Bar of Texas, and the American Bar Association.

He and his wife, the former Lena Lou Ward of Greenville, live with their two daughters, Elizabeth Louise and Celia Ann, at 256 Hedwig Road in Houston.

Dillard W. Baker New General Attorney

DILLARD W. BAKER, new General Attorney for the Humble Companies, has been a member of Humble's Law Department since 1937.

Born in Coleman, Texas, in 1912, he moved with his family to Austin in 1925. After graduating from the University of Texas Law School in 1936, Mr. Baker entered law practice with his father and brother in Coleman. He began work in the claim and right-of-way division of Humble's Law Department late in 1937.

In 1942 Mr. Baker transferred to the trial division and has been continuously engaged in trial work since that time. His new job makes him head of the trial division, with responsibility of handling all law suits filed against the Humble Companies.

Mr. Baker was married to Mary Margaret Thomas of Gause, Texas, in 1938.

He and his wife live with their two sons, Kirk and Roger, at 601 Bunker Hill Road in Houston.

Dillard W. Baker

Working with HUMBLE

Seismic Party at Work in West Texas

GEYSER of mud and water bursts skyward from geophysics shot hole fired by Humble Seismic Party 18, exploring for oil in dunes near Monahans. Such explosions create artificial earthquakes from which vibrations are recorded on film. Geophysicists study and interpret these vibration patterns to determine what structures may lie below.

While the men of Seismic Party 18 cope with problems of exploration in the desert, others take their skills and equipment up into the mountains, adapt them to operate in muddy marshes, and even venture out into open waters of the sea itself.

Biologists taking core from bottom

OYSTERS AND OIL

Scientists, working independently and separately, prove Louisiana oyster mortalities caused by newly-discovered parasite; not by oil operations

PART II

IN THE early 1930's, oil operations began in southern Louisiana on a rather substantial basis. Though the terrain presented formidable difficulties, the oil industry was able to devise and build vehicles and adapt methods which made it possible to search for, produce, and transport oil in this country of marshes, lakes, bayous, and swamps.

For a time, all went well, the oil and oyster industries living and working peacefully together. To be sure, oyster production fluctuated and continued to have its waves of mortality. But this was nothing new so far as the history of oyster production in Louisiana was concerned. These were the same problems faced by the oystermen's fathers and their grandfathers before them since the beginning of oyster cultivation in Louisiana. The Biennial Reports of the Louisiana Department of Wildlife and Fisheries, as far back as they go into the late 1800's, reflect periodic waves of mortality and distress on the part of oyster growers.

Thus, up to the time oil operations came upon the scene in the early 1930's, we have a situation into which no new influences or life-patterns had been injected. The oystermen had their good years and their bad years, just as do all men who depend for a livelihood upon growing things. And when

they had their bad years, without apparent cause or scientific knowledge on which to base accusations, it was easy enough to blame the weather or the oyster's natural enemies in the sea around it.

The early thirties, however, brought a new situation—so far as Louisiana oystermen were concerned. Here, as if made to order, was a newcomer to their domain—a completely strange newcomer which might well be made a convenient scapegoat. Why not, reasoned many oystermen, lay the blame for all their troubles at the feet of this bustling stranger? It had moved in without invitation, and its operations to oystermen were as mysteriously foreign as the equipment it used.

Henceforth, if oyster production declined, the oystermen had a ready-made excuse right at hand. They pointed an accusing finger at the oil industry. And the lawsuits began to pile up as oystermen, one after another, alleged that oil operations were damaging their business.

In the absence of scientific data, it is quite likely that many of the complaining oystermen were honestly convinced, in their minds, that the oil industry *was* to blame for oyster mortality. A crop of oysters cannot be seen and visually checked periodically like a herd of cattle or a field of cotton. When a blight or a disease or a wave of predators sweeps across an oyster bed, results are not evident until later, and by that time the cause has either withdrawn or lies hidden to all but scientific examination.

A rancher may send for the veterinarian as soon as his livestock shows signs of illness. The oysterman has no such opportunity. His stock-in-trade lies under water; the first inkling he has of trouble is when he finds empty shells in his oyster beds. The cause? He does not know, nor is there any reason why he should know. Once an oyster is killed or dies—by whatever means—the shell opens and the body is devoured by marine life or is swept away. Without a *corpus delicti,* determining the cause of death is difficult, sometimes even for a competent biologist.

Why, when his production declined, did the Louisiana oysterman not call for scientific advice and help? The answer is simple. The State of Louisiana's Conservation Department, operating under a limited budget, has one biologist who works on oyster problems—and this, remember, is the nation's largest oyster-producing state! One man might as well command the sun to stand still as try to solve state-wide problems of oyster mortality. The area is too large, the problems too many, and the effort too time-consuming.

Task Force of Scientists

Obviously, then, the only recourse left open to oil companies against whom suits had been filed was to employ a corps of biologists and research men to determine whether the oil companies were guilty as charged. If oil operations *were* causing oyster mortality, oil men wanted to know about it, so they could change their methods of operating in the oyster producing areas.

This was probably the first such task force so employed by private capital in the history of marine biology. For once, an adequate staff of scientists and all necessary equipment would be provided for the single job of studying everything about oysters. These men, of course, were disinterested scientists. They came from colleges, universities, or various research and scientific organizations.

In December, 1946, Gulf Oil Corporation asked Albert Collier, marine biologist, to find out whether oil operations were harming oysters; and if not, to find what was causing mortality. Thus was begun a four-year project at Pensacola, under the direction of Sammy M. Ray, a biologist, and at Grand Bay, under the supervision of Joe Bell, a chemist.

The Texas Company joined this effort soon after by contracting with the Texas A. & M. Research Foundation "to conduct to conclusion a thorough, scientific, and impartial research . . ." Director of this project was Dr. Sewell H. Hopkins of the A. & M. Department of Biology. Field work was supervised by Dr. J. G. Mackin, professor of marine biology at Texas A. & M. College.

Soon after this work got under way, other companies joined in, and more scientists were engaged to study oysters. At one time, more than 90 men were involved in the study, and more than half that number worked full time for three years.

Dr. Mackin's efforts were concentrated around laboratory studies at Grand Isle. Other work was carried on at colleges and universities. Experiments were conducted at Texas Christian University under the direction of Dr. W. G. Hewatt, head of the Department of Biology; at Louisiana State University under Dr. Harry Bennett, professor of zoology; at Texas A. & M. College under Dr. Fred Jensen, head of the Department of Chemistry and Dr. S. O. Brown of the Department of Biology.

Coastal work found studies being conducted by Dr. E. J. Lund and Dr. Gordon Gunter at Port Aransas. G. Robert Lunz worked at Bear's Bluff near Charleston, South Carolina.

Nor was this all. In addition to the above-named scientists who worked full time, consultants included Dr. Peter Korringa, head of shellfish research for Holland; Dr. Claude E. ZoBell of the Scripps Institute of Oceanography at La Jolla, California; Dr. Thurlow Nelson of Rutgers University; and Dr. Ray Elsey of the British Columbia Packers.

On behalf of the State of Louisiana, James N. McConnell, chief of the Division of Oysters and Water Bottoms, enlisted the help of Dr. H. Malcolm Owen, now chairman of the Department of Biology at the University of the South at Sewanee, Tennessee.

Additional research was conducted at Port Sulphur and Biloxi for Freeport Sulphur Company. This work was headed by the late Dr. A. E. Hopkins, once director of the Gulf Coast Research Laboratory at Ocean Springs, Mississippi.

All scientists and research men worked independently, or as a member of the research foundation retained to do the work. Their job was (1) to determine whether there was oyster mortality among Louisiana oysters, (2) whether oil operations were causing it if mortality did exist, and (3) if oil operations were not the cause, just what was causing mortality.

At the time the oyster research work began, because of past work of biologists (meager though it was on Louisiana oysters), the oil companies felt that oil pollution and oil operations were not determining causes in oyster mortality. Oil losses were very small, compared with the vast amount of water in the area. To contaminate everything in the vast watery domain that is southern Louisiana would take more oil than the wells there could produce.

In effect, however, the oil companies were taking a gamble when they set up the oyster research project. There were

Inspecting oysters at Grand Isle laboratory

no positive assurances that all oil operations would be given a clean bill of health after all tests had been made by scientists and all results were checked and evaluated. Disinterested scientists, the oil companies knew, would reveal the facts as they found them—let the chips fall where they might —without regard for the consequences, or for who got hurt in the process.

It was, then, a long and expensive gamble—but one that had to be taken before any definite and intelligent answers could be obtained concerning the three objectives of the project, as outlined above. And, after many years of intensive research, it was a gamble that paid off.

One by one, after thorough and painstaking experiments, tests, and examinations of all kinds, the scientists eliminated oil operations as a cause of oyster mortality. Geophysics and other exploration activities, they found, did not harm oysters. Oil pollution, after extensive study, was ruled out as a harmful factor. So was the operation necessary to producing oil once it was found. Drilling mud, alleged to be harmful to oysters, was found by the scientists to be completely harmless. It should not be supposed that these conclusions were reached in a matter of weeks, or even months. They were the results of seven years study, and the work is still in progress on some phases of work concerned with studying factors which *are* a cause of oyster mortality.

Scientific Work and Records

As a result of those seven years' work, a great mass of scientific data was assembled. Daily salinity tests were made over large water areas. Continuous and painstaking records were kept of water temperatures in bays and bayous. Along with these came a multitude of chemical analyses on water and mud samples. All these data were compiled in addition to extensive and intensive studies on the oysters themselves.

Tests on oysters went forward in the field as well as in the laboratory. In order to study the total effect of all environmental influences on oysters, the scientists frequently worked with specimens which they had raised carefully from the spat stage to adulthood. Specimen oysters were drawn from all areas. Some were transplanted from one area to another, to study effect of changes in environment.

Nor was the experimental work with oysters confined to Louisiana. Some phases of oyster study went forward in Texas, Florida, Mississippi, and South Carolina. It was a concerted effort to find out everything that could be learned about oysters.

Out of this great effort grew voluminous records and reports. Only a few of the reports have been published. It is anticipated, however, that additional reports will be offered for publication as the scientists correlate their great masses of data.

While there is not room here to summarize all tests, or go into great detail on any tests, some mention should be made of the general method used in carrying on experiments. That method was to use a group of "control" oysters with every group used in an experiment.

This gave the scientists an opportunity to study and draw comparisons between two groups of oysters—one group exposed to the experiment and the other group not exposed to it. If no more oysters died in the experimental group than in the control group, the conditions set up by the experiment could not be concluded to cause unusual mortality.

The following brief accounts will outline a few of the things scientists did to determine the effect of oil and oil operations on oysters. In all cases, expressions like "no ill effects were noted," or "oysters were not harmed," mean that oysters in the experimental group followed substantially the same life patterns and went through the same life processes as those in the control group. In other words, no more died in one group than in the other.

Blanket of Crude Oil

Albert Collier, a marine biologist employed by Gulf Oil Corporation, decided to subject oysters to a stiff pollution test and see how they made out. To carry out this experiment, he built boxes, open at the top and covered with wire mesh across the bottom, which floated in the bay with several inches of the box extending above the waterline.

Oysters were placed on the wire bottom, the boxes anchored above natural bedding grounds, and a thick blanket of crude oil was poured over the top of the water in the box. This, of course, was a much sterner test than oysters would ever be subjected to in nature, even if crude oil were discharged or lost over oyster beds. In that case, the oil would be thinned out by action of wind and wave, and eventually dispersed by tide action. Trapped in the boxes, oil had to stay where it was placed—right over the oysters.

The oysters thus trapped did not mind in the least. Not only did they survive and go about their life processes as usual. They even brought forth baby oysters which grew and prospered as well as the parents.

In another and somewhat related experiment, scientists jetted water through oil for six months into an aquarium containing oysters in the laboratory. The emulsion of oil and water from the jetting action had no discernible effect on the oysters. To make this test still stiffer, scientists after a time lifted oysters from the aquarium and sprayed them directly with crude oil. Even then, no ill effects were noted.

In point of fact, even if oil had been found to be dangerous to oysters, cold economics on the part of the oil companies would work to protect them and the other marine life of the Louisiana coast. With oil selling at $2.60 a barrel and up, no oil company can afford to waste it in bays and bayous!

Drilling Mud and Bleed Water

Plaintiffs in the lawsuits against the oil companies contended that drilling mud used in oil operations was harmful to oysters. Scientists used laboratory experiments to determine whether there was any validity to that claim.

Covering the bottom of an aquarium with drilling mud, they placed live oysters on the mud bottom. This, too, was a sterner test than live oysters would ever have to face in their natural habitat. If the plaintiffs had been correct in their charges, the oysters in this experiment had not long to live. Yet they did live, and suffered no ill effects.

Another experiment was to determine whether bleed water, or effluent from production operations, killed oysters. Oystermen claimed it did.

In setting up this experiment, scientists placed oysters in a tank and exposed them to a constant flow of bleed water. The oysters were not harmed. Indeed, oysters placed within 80 feet of a bleed water outlet showed no ill effects. On other

Scientist conducts laboratory test

occasions, oysters were found growing on piling near bleed water outlets.

Dr. Owen, working for the Louisiana Department of Conservation, had this to say about bleed water: "As a conservationist interested in the successful exploitation of an expendable resource, I abhor the thought of the discharge of any industrial pollutant into natural waters. *Scientifically, I have not found the evidence to conclude that such discharges have been responsible for mortalities of oysters.*" (emphasis supplied).

Silt and Dredging

Another claim on the part of the plaintiffs was that silt from dredging operations by oil companies was hurting oysters. This could be broken down rather quickly. The Mississippi River itself is estimated to carry *almost two and a half million tons of sediment every day* into the waters of the oyster growing area. Any silt stirred up by dredging operations would be infinitesimally small by comparison.

Silt added to the water by dredges falls out and settles to the bottom within a few hundred feet of the dredging operations. By contrast, waves caused by squalls and bad weather stir up silt by the tons. It is the activity of Nature—winds and waves and currents—that causes bottoms to silt up. This same action builds new land and cuts new channels in the area. In fact, the whole area is built on silt.

As for dredging itself—clearing places for drilling, etc.—Humble and others are always willing to pay for any actual physical damage to oyster beds as a result of such operations. In the same way, the industry pays for any portion of an inland crop destroyed to make a path for a pipeline, or for a drilling rig.

Illustrated by
E. M. Schiwetz

Tonging oysters in Barataria Bay

Geophysical Activity

Oystermen claimed that charges of dynamite set off during exploration activities were killing oysters. As early as 1944, Dr. James Nelson Gowanloch, Chief Biologist for the State of Louisiana, conducted experiments to prove or disprove that allegation. In that year, Gowanloch found that 800 pounds of dynamite failed to kill oysters when exploded only 50 feet from oysters trapped in cages suspended in the water.

Gowanloch was still not satisfied, however. He felt that additional work was needed. The following year he reported on experiments "in which great care was used to check the validity of the conclusions." These experiments showed that oysters were not damaged by 400 pounds of dynamite exploded 25 feet under the surface of an oyster bed.

These findings were substantiated over and over again in experiments which also inquired into the after-effects of geophysical shots. The maximum legal limit for such shots is 50 pounds of dynamite; a typical operating charge is only 20 pounds. In one test, charges of both sizes were set off 20 feet from oysters. No apparent harm resulted, proving the oyster a hardy little beast, indeed.

Carrying the experiment further, some of the oysters which had been subjected to the explosions were moved to other bedding grounds. After four months, the per cent survival of oysters remaining at the experimental site was greater than that of the oysters which had been moved away!

The effects of seismograph work on oysters is discussed in a report on "Experiments on the Effects of Seismograph Exploration on Oysters in the Barataria Bay Region, 1949-50," by Fred W. Sieling. At the end of the report, Sieling concludes that:

". . . with regard to the test of possible adverse effects of seismographic exploration on oysters, all results were negative. The sinking of shot pipes, the explosions, the pulling of the pipes, and the subsequent flow of gas from the shot holes, had no detectable effect on the survival of oysters or on their condition as determined by analyses, even at distances of 20 feet (in trays) and 40 feet (loose on bottom) from the shot point.

"The only logical conclusion that can be drawn . . . is that seismographic 'shooting' of the maximum intensity permitted in bays or marshlands by Louisiana law, when carried out by what we are informed is the normal operating procedure, has no adverse effect on oysters 20 feet or more from the shot points, either immediately or over a period of 8 months.

"The data derived from the experiment do tend to show

what has been shown by other experiments carried out by the Project 9 staff, that mortality of oysters in the Barataria Bay region is correlated with salinity and temperature."

Effect of Mississippi River Changes

Major influences on Louisiana oyster production have been changes in the flow of the Mississippi River and its distributaries. A summary of these changes and the significance of their influence on oyster production are set forth in a report by Dr. H. Malcolm Owen, who was employed by the Louisiana Department of Wildlife and Fisheries to study the oyster situation.

The watershed of the Mississippi covers 1,250,000 square miles, about one-third of the land area of the United States, according to Dr. Owen. Annual water discharge at the Mississippi's mouth is estimated to be more than 785 billion cubic yards. One authority (Clark, in 1924) said that nearly a quarter of a million tons of nutrient salts are carried down the river every year, not including amounts of many trace elements known to contribute to the physiological balance of oysters.

Beginning as far back as 1717, events began which were to help change the future course of oyster growth on the Louisiana coast. In that year, the first levees were thrown up along the Mississippi. In fact, early grants from the French king stipulated that landowners levee their land along the river, and by 1744 those who had built no levees forfeited their land. By 1812, these levees extended downriver for 20 miles and upriver as far as Baton Rouge. This system of levees on the main stream and many of its tributaries helped control disastrous floods, but it also had the effect of cutting off many oyster beds from their former source of fresh water.

Damming of major Mississippi River distributaries made this situation more acute. By 1904, three of the four major distributaries had been dammed at their source. These three included Bayou Manchac, on the east, dammed in 1828; Bayou Plaquemine, on the west, dammed in 1868; and Bayou Lafourche, dammed in 1904. Taken together, these dams deprived Terrebonne, Barataria, Timbalier, and hundreds of smaller bays of their regular sources of fresh water brought down by floods.

On the other hand, the history of the Atchafalaya River, the fourth major distributary, has taken just the opposite turn. As levees rose below the head of the Atchafalaya, and as the other distributaries were dammed, the size of the Atchafalaya steadily increased. Today it has grown so large that Army Engineers are faced with the problem of preventing it from becoming the main channel of the Mississippi, which could conceivably cut New Orleans off from its outlet to the Gulf.

At the present, the net effect of these changes in flow has been to discharge more fresh water at the mouth of the Mississippi and into Atchafalaya Bay. Other areas formerly served by Mississippi floodwaters now receive correspondingly less fresh water, and many of these are included in the oyster-producing areas. In these areas, there is no longer an annual cycle in salinity so essential to oyster growth and discouragement of oyster enemies. Instead, there has been a trend toward increasing salinity in these waters.

Since the construction of levees and dams, some of the affected areas have received large volumes of fresh water only by "crevasses," or breaks which spilled flood-stage waters across the area. For a time, the water released by these crevasses would kill out the oysters, but there was always a prolific and relatively rapid recovery. Since 1927, however, no major crevasses have occurred on the river. Except for the mouth of the Mississippi in the central portion and Atchafalaya Bay on the west, bays which once received regular supplies of fresh water are becoming more salty. This increased salinity has encouraged an increase in population of natural oyster enemies in these areas, particularly conchs. Coupled with this, the oysters of those regions have been deprived of life-giving nutrient material carried in the fresh water.

Disease Parasite Discovered

If oil operations were not killing oysters, what was to blame? Oystermen already knew about the inroads of natural marine enemies mentioned earlier in this report—the conchs, crabs, worms, fish, and the like. And the influence of declining fresh water supplies on the increasing numbers of these enemies has already been discussed. But wasn't there something else—something insidious and as yet undiscovered —which was thinning the oyster ranks at an alarming rate?

There was, and the scientists found it! Significantly, three individual scientists, all working separately and independently, found the villain about the same time—1949 to 1950. The men were Dr. J. G. Mackin, of the Texas A. & M. Research Foundation; Albert Collier, employed by Gulf Oil Corporation; and Dr. H. Malcolm Owen, working for the Louisiana Department of Conservation and now chairman of the Department of Biology at the University of the South at Sewanee, Tennessee.

The disease-causing organism found in oysters by these three scientists was a parasitic fungus they called *Dermocystidium marinum*. A somewhat similar disease affects human beings in the form of "athlete's foot."

In its ravages against oysters, Dermocystidium attacks the oyster's body. The disease progresses until the oyster succumbs to Dermocystidium itself or is left so weak that it opens its shell and is eaten by predators.

To make matters much worse for Louisiana oystermen, Dermocystidium were found to thrive under conditions which prevail in Louisiana waters—high temperature and high salinity. In connection with this, it should be remembered that it is in the hotter months of the long Louisiana summer that oysters spawn, and that spawning weakens oysters. Thus, the worst time for an oyster is the best time for Dermocystidium—a combination which spells doom for an alarmingly larger percentage of the Louisiana oyster crop. Mackin, Owen, and Collier, in a joint paper on the subject, had the following remarks to make about this situation:

"Data were acquired which showed the association of this organism (Dermocystidium) with dead or dying oysters under certain environmental conditions, the limits of which could be reasonably well defined. The chief controlling factors appeared to be temperature and salinity, low temperature and low salinity evidently retarding the development of the infestation.

"Oysters in all conditions of health were found to be susceptible to infestation, but factors resulting in fatigue, such as spawning and miscellaneous adverse environmental

conditions accelerated the intensity and spread of the organism.

"The finding of this organism marked a turning point in the investigations. It was considered to be of great importance . . ."

After seven years of intensive scientific study, results of the combined knowledge and efforts of all scientists working on the problem of oyster mortality led to these conclusions:

1. Dermocystidium is a killer. Under conditions of high temperature and high salinity, it has caused unusual mortalities of oysters in Louisiana waters. It is the primary cause of unusual mortalities, with natural predators a secondary cause.
2. Though deadly to adult oysters under conditions of high temperature and salinity, Dermocystidium apparently does not affect spat or oysters less than 16 weeks old. After that age, there appears to be an increasing susceptibility to the disease.
3. Dermocystidium is water-borne, and is capable of reaching epidemic proportions when conditions favoring its development are present.
4. Dermocystidium is not harmful to, and cannot be transmitted to, human beings. Biologists have not been able to transmit it to the clam, which is closely related to the oyster. It seems to be strictly an oyster fungus.
5. The production of oysters in Louisiana is seriously affected by Dermocystidium, which greatly reduces the money value of the annual crop.
6. Lack of fresh water has reduced oyster production west of the Mississippi.

Conclusion

After many years of hard work, scientists working independently of each other, and representing divergent interests, have proved that oil operations do not harm the oyster business. They have proved, instead, that the main trouble—the real killer—is a parasite which flourishes under conditions found most of the year in Louisiana waters. Scientists found that parasite, studied its devastating effect on oysters, and agree that it is the major cause of oyster mortality in Louisiana. Our country as a whole, and oyster growers in particular, owe a debt of gratitude to the scientists. The names of John Mackin, Sewell Hopkins, Albert Collier, Sammy Ray, Jay D. Andrews, and Malcolm Owens will be recorded in the annals of science as major contributors of new and valuable scientific knowledge.

Using the information now available to them, oystermen are in a better position to defend themselves and improve their yield. It is simply a matter of making the best use of available scientific data by side-stepping obvious disadvantages. For one thing, Dr. Mackin had devised a plan which would take into account that Dermocystidium is most active in summer, plus the fact that young oysters are not affected by the disease.

Dr. Mackin suggests that oystermen might transplant their crop at the end of the summer, leave them on the reefs through the next summer (when they would still be young enough to be relatively immune to disease), and harvest them sometime in March of the following year. He would transplant *very young* oysters, instead of waiting until they are several months or a year old, as currently practiced. A test of this technique, practiced by Dr. Mackin, proved quite successful.

Another suggestion offered is to shift oysters to comparatively fresh waters in the summer, when Dermocystidium is raging, and to carry them back to saltier waters in the winter, when the disease has died down. This would increase the cost and effort of handling the crop, but it might pay off in increased yield.

Now that all tests are made, scientific work yet to be done consists of correlating data and preparing final reports. When these are in, the oyster stands in good position to be one of the best-documented animals in the world. If proper use is made of techniques which take advantage of all that has been learned in this vast research project, oysters could become more plentiful than beef on the dinner tables of the world.

Sparkling at base of rocks is one of the pools that gave the Hueco Tanks their name. Note huge rock shelter that begins at mid-center of picture and extends to the upper right corner. Indians painted pictures and symbols on roof of this shelter.

Near El Paso are historic waterholes which have slaked the thirst of Indians, Forty-Niners, and other emigrants. They are known as

THE HUECO TANKS

THIRTY miles east of El Paso, reached by a few miles of dirt road off Highway 62, lie the historic Hueco Tanks. In Spanish, *hueco* means "hole, or hollow." Water which collects in these natural cisterns have made the place famous.

Once a favorite campsite of Indian bands, the tanks became an oasis for "Forty-Niners" and others who moved westward on the famous Emigrant Trail to California. Still legible in nearby caves and rock shelters gleam names and dates scrawled by those adventurers.

The next groups to come this way chased no golden rainbows, but found the way as hard and dangerous as any who went before them. These were drivers, guards, and passengers on stagecoaches of the historic Butterfield Overland Mail. In 1858, when the Butterfield stage made its first run between St. Louis and San Francisco, Waterman L. Ormsby, a special correspondent for *The New York Herald,* climbed aboard to write about the journey. He must have thought that the Hueco Tanks fell far short of their billing as a watering place, for he arrived at the tanks when the whole countryside lay gasping in the grip of drouth. Ormsby wrote, dolefully:

> "On reaching the Hueco Tanks we found an excellent corral and cabin built, but to our consternation the station-keeper pointed to two 8-gallon kegs, saying 'That is all the water we have left for a dozen men and as many head of cattle'."

With or without water, Ormsby and his fellow travelers must have been impressed by the fantastic rockpile which forms the tanks. By comparison with the yellowed and gently contoured Hueco Mountains around them, the Hueco Tanks are—to the layman, at least—a kind of geologic freak sculptured in dark, bare stone. Not at all like mountains, they are a stony jumble from 200 to 400 feet high. The whole place looks as if some prehistoric giant had idly flung one boulder upon another until the pile came thundering down. Geologists say that rocks which form the tanks were once a seething puddle which boiled and bubbled up through a weak spot in the earth's changing crust, much as toothpaste is squeezed from a tube.

The glowing mass did not reach the surface, but after it cooled and hardened, erosion cut the softer rocks from around it, leaving it exposed. Further erosion formed depressions that filled during rains. These made the Hueco Tanks a good source of water in a hot, salty, bone-dry country.

CONTINUED

Indian artists often departed literal style and resorted to interesting patterns. Red color may symbolize blood, life.

Sun symbol, bright and well preserved, adorns the roof of a rock shelter. Significance of the arrow at center is unknown.

INDIAN PAINTINGS ON ROCK

AN ADVENTUROUS spirit, a love of Indian lore, a willing pair of legs, and some rubber-soled sneakers are all anyone needs to roll back the centuries at the Hueco Tanks. For with these, in a few hours of careful climbing, one can find among the caves and cliffs scores of colorful pictographs painted by Indians long ago.

In many cases, these are not merely art for art's sake. They are pictographs with a purpose. Even a casual study indicates that the savage artists who drew these pictographs served in at least triple roles of newsmen, historians, and court painters.

Had hunters just returned with a bulging bag of game? As news reporter, the artist put his talents to the happy task of drawing animals with projectiles sticking from their sides. And he doubled as a sign painter, too. According to an old Indian who once visited the place, those white snakes painted at the Hueco Tanks point with their heads toward the nearest water.

"The Rabbit Dance," on roof of rock shelter, shows native dancers invoking blessings of gods on rabbit hunt. Indians drove rabbits into circle, killed them with sticks.

Apparently, these red Rembrandts delighted in recording religious rituals and other ceremonies. At one place in a Hueco Tanks cave, a line of white figures shows hunters doing the "Rabbit Dance," to invoke the blessings of the gods before a rabbit hunt. At the same site is a well preserved sun symbol, painted in yellow with rays fingering outward from around the disc, in homage to the powerful Sun God.

Moving on around the tanks and up into the rocks, one finds paintings in almost infinite variety. There is much preoccupation with animals—a small red deer, with delicately drawn antlers; an antelope taking off in startled flight; mountain sheep, and others. Curiously designed face masks, some crude but others showing excellent grasp of design and draftsmanship, leer at passersby. Even insects are found here. One of the best examples is a pair of red dragonflies, or some such insect, poised daintily in mid-air. Just a few

feet away, on the same rock face, is a lovely design in red which may be a beetle or a butterfly.

Not all pictographs are easy to identify. Like the cubists and abstractionists of our age, some Indian artists seemed determined to perplex their audiences. One such puzzler, after experts gave up in despair, is popularly called "the woman with a teapot." That is as good a guess as any, but the whole thing may have been intended as a crude map, complete with streams and hunting grounds.

In other places where the impressionist influence runs wild, the painter seems to have relaxed by losing himself in mazes of zig-zag lines and serpentine flourishes, much as today's businessman "doodles" on a scratch-pad. Even these are often striking, as in the case of the vigorous loops and lines which suggest a bird in flight.

One art form used by the Indians seems to fall somewhere between recognizable figures and geometric doodling. In this type of painting, the figure is neither man nor beast, but often a combination of the two. An excellent example is a three-foot-long drawing (in white paint) of what appears to be a whip-tail scorpion—the storied "vinegarroon" of the West. Its head, however, is humanized and may easily be taken for an Indian's head adorned with a set of buffalo horns. No doubt there is much symbolism in these paintings which escapes accurate interpretation by today's visitors.

With no alphabet or written language, picture writing was the Indians' natural outlet for self-expression; an artistic means of interpreting their world and way of life as they saw it. And with no formal training or modern materials, they did an amazingly good job. For their paints, they mixed native minerals and greases—or used charcoal. For brushes, they employed the blunt end of a stick or bundled together small fibers—or perhaps daubed busily with stubby forefingers. Finger smears and hand-prints here and there on the rocks show they had little regard for leaving a clean canvas!

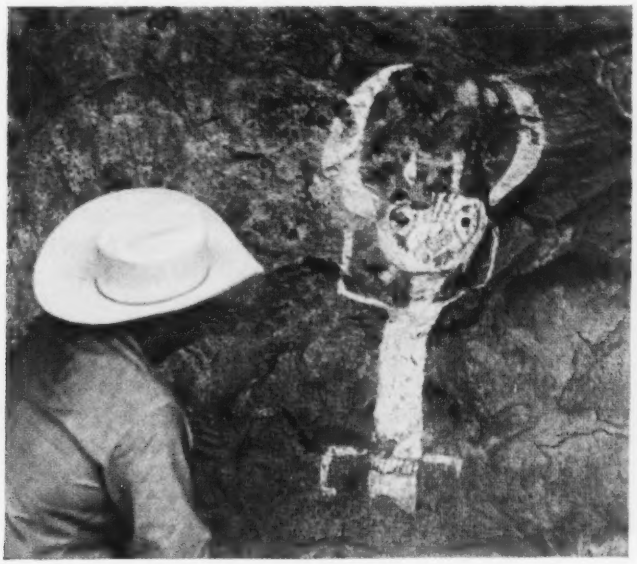
How old are the paintings? Scholars are reluctant to commit themselves, and with good reason. Estimates, however, run anywhere from a thousand years and more on the older paintings to a century or less for the newer ones. It may be reasonably presumed that the older art was the work of Basket Makers or Pueblos, or both. Some of the "modern" work is almost certain to have been painted by Apaches during the 1800's.

At some sites exposed to wind and rain and easily reached by man, weather and vandals have dimmed or destroyed some beautiful work. But higher up in the caves and cliffs, in the more protected places, exciting remnants of this lost culture still glow with remarkable brilliance. With proper care, they should last for hundreds of years more.

The Hueco Tanks, quite naturally, are a favorite picnic ground for El Pasoans and others in that region. And, although they stand near the far western tip of Texas, the tanks continue to draw a surprising number of visitors. A study of this unique Indian "art gallery" is worth the time and trouble it may take to get there. While pictographs are found over a wide area of West Texas and in other states, it is not often one can find them in such great concentration, or so readily accessible, as at the Hueco Tanks.

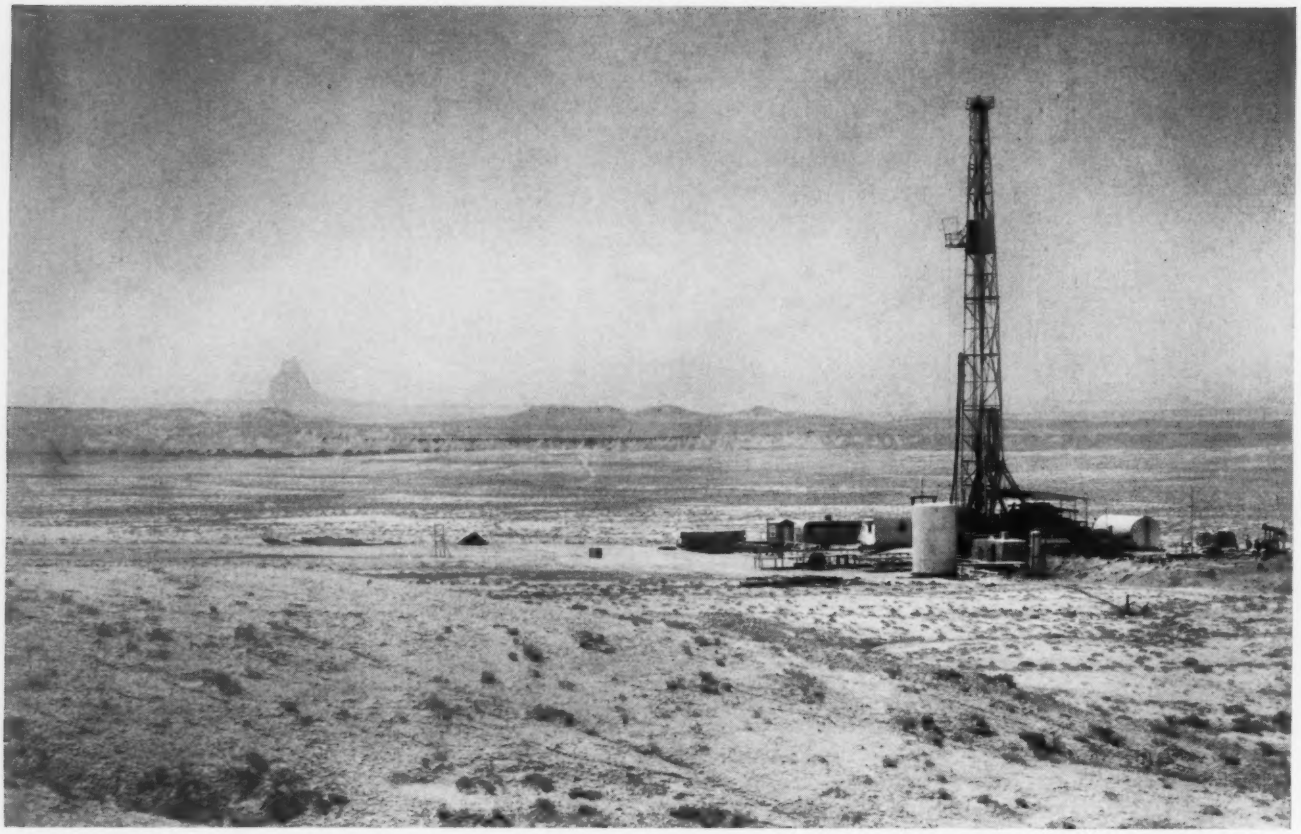
Antlered deer stands bright and clear on cliff. Hand shows size of painting.

Editor's Note: These are photographs of Indian paintings, called pictographs. Indian pictures scratched or pecked into the stone are called petroglyphs. Several of these are found at the Hueco Tanks. One shows an Indian chief in war dress, brandishing a tomahawk.



Stuart Henderson, who lives at Hueco Tanks, studies humanized pictograph of "vinegarroon," or whip-tailed scorpion.

"Headless Woman," pictured near white rattlesnake, may be a death symbol. Note names and dates left behind by emigrants.



Rigs in the wilderness, like this one north of Shiprock, New Mexico, are in constant radio contact now with Humble's Farmington District office. New communications system helps speed supplies and specialists to the field as they are needed.

Unique radio system in Four Corners area helps Humble solve tricky problem of

KEEPING IN

District Superintendent Russell Lilly keeps in contact with mobile unit.

WESTWARD toward Arizona glows the eroded wonderland of Monument Valley. To the east beyond the Continental Divide rise the peaks of the Nacimiento Mountains overlooking valleys of the Jicarilla Apache Indian Reservation. To the south lies barren desert, broken occasionally by a forbidding canyon, a lonely mesa or Indian hogan.

Into this ruggedly scenic Four Corners area of northern New Mexico and Arizona Humble last year set about the task of drilling for oil. And in doing so, crews immediately collided head-on with the twin, age-long problems of the area—transportation and communication.

Lonely well sites sometimes were connected to the nearest highways by 50 miles of winding, dusty roads bulldozed from Navajo or Apache trails. Steep, narrow lanes wound up barren buttes and pinon-covered mountain sides before stopping abruptly at rigs perched on a ledge or bluff. And sudden flash floods turned dry washes into swollen rivers, wiping out even these meager trails at times.

Under such rough conditions, it was difficult to get supplies and services as they were needed, especially in emergencies. When a drill bit dulled, when mud circulation in the hole was lost or when well loggers, cementers, and welders were needed, long hours of valuable time were lost before word could be sent back to District Headquarters in Farmington, New Mexico, and the needed equipment, supplies or specialists moved to the scene.

To help solve these problems, Humble radio engineers stepped in with a plan of action that has virtually lifted these wildcats out of the wild. It's all done with a new high-frequency radio

Driller on Navajo Reservation wildcat keeps Humble office advised on progress. Radio is in shack, apart from rig.

Relay station on Colorado peak is heart of new system. Messages travel between rigs and Farmington via tower.

IN TOUCH IN THE HINTERLAND

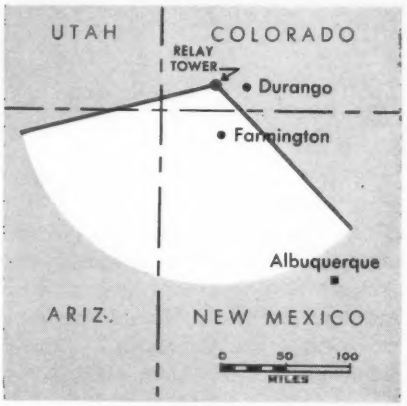
communications system, utilizing an unmanned relay station on a southern Colorado mountain peak. Via the airways, employees in Humble's District Office are in continuous radio contact now with the various contract drilling crews—sometimes 150 road miles away—and with company personnel in mobile-unit-equipped automobiles supervising the scattered drilling and production operations in the 13,000 square mile operating area.

When an emergency arises now, a flick of a switch and a few words into a microphone send supply or service trucks rumbling over the dusty desert roads to the rescue. In case of sickness or injury at the rig, medical aid can be rushed to the spot on short notice.

Heart of the new communications system is the relay station on Menefee Peak west of Durango near Mesa Verde National Park and 45 air miles north of Farmington. Messages are transmitted back and forth from rigs in the field to an antenna on the 9,000-foot mountain, then on to the Farmington Office. The system has line-of-sight transmission—like television—and the high altitude relay station overlooking Humble's operations to the south was necessary to insure broad coverage across the mountains, ridges and desert.

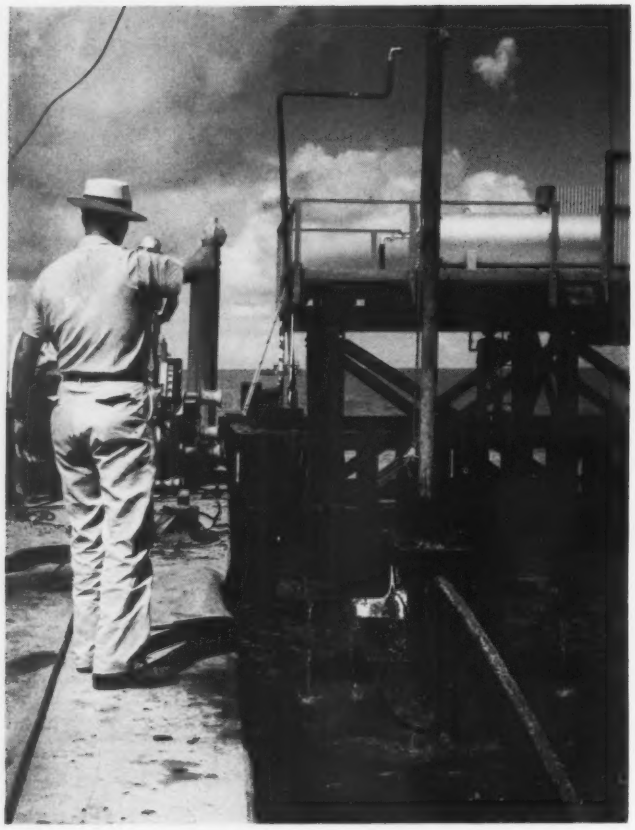
Use of radio communications is not unique for Humble's drilling operations. But the new installation in the Four Corners area represents the first time the Company has utilized such a high and remote location for a relay tower.

Every day the new system is proving its merits, helping keep Humble's oil and gas wells in touch and out of trouble in the New Mexico and Arizona hinterland.

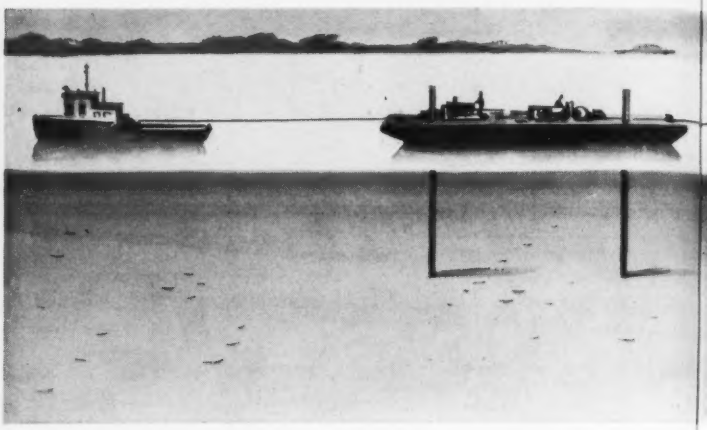


Range of transmitter fans out from relay station over 13,000 square miles.

Mrs. Arlene Wheeler, Humble operator in Farmington office, takes call from rig.



Making ready to plow, inventor Box signals "lower away" to crane operator. Here, plow will bury 4-inch line in bay.



This drawing shows how tugboat and two barges work together to pull the underwater plow. The plow (right) digs trench three or four feet into the bay floor. Strong cables connect tug, barges and plow. The three-joint pipe sections are

With implement designed

IT'S NEVER

BRANTON BANE BOX sat straight up in bed, snapped his calloused fingers and said, "I've got it!"

"You've got what?" mumbled Margaret, his wife.

"A plow. That's it. A plow. You can plow pipe right into the ground."

But Mrs. Box drifted back to sleep and her husband, Humble welding supervisor at Bayou Sale in Louisiana, didn't get the chance to explain his nocturnal brainstorm.

What he had "got" was the inspiration for a gigantic plow—similar to the old middlebuster every farmer knows—to bury pipe line in shallow bays and marsh lands. It was an inspiration destined to be profitable to the Company and bring Box a Coin-Your-Ideas award of $200.

For years, the laying and maintaining of pipe lines in salt water bays and semi-swamp land has confronted Humble people in production and pipe line operations with special problems. In these areas, pipe is an easy prey to costly corrosion. Little sea animals (mostly barnacles) devour the wrapped coating. Meanwhile, the highly corrosive salt water does its destructive worst.

Freezing of hydrates in flowlines during winter poses an even greater problem. On natural bottom, the pipe is exposed to the radiator-like cooling action of the tide as it moves to and fro.

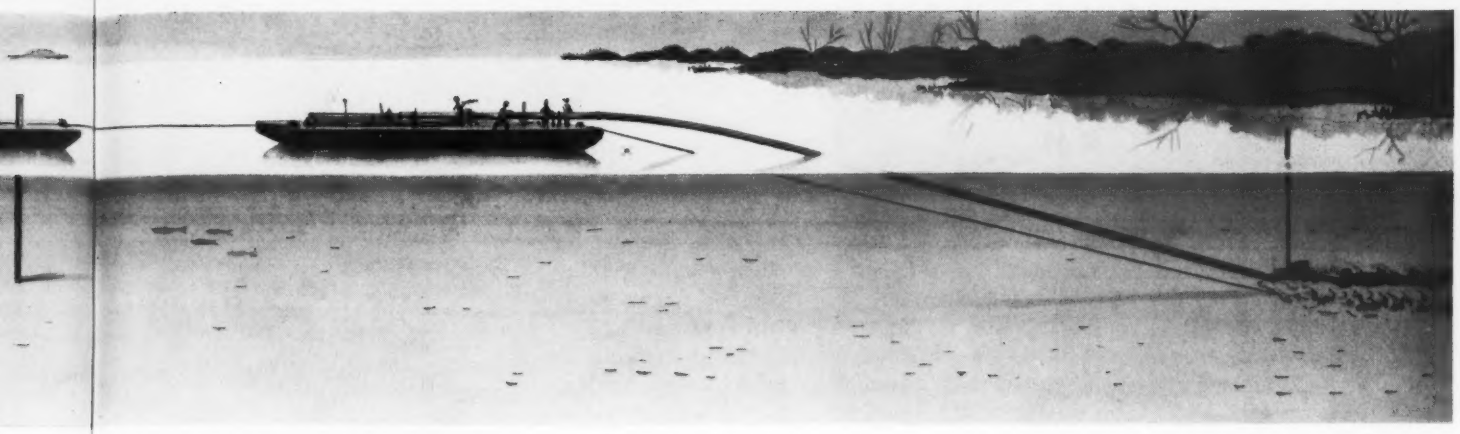
The logical answer to both corrosion and freezing was to bury the line—but how? It *could* be done at least two ways. A trench could be ditched underwater, just as on dry land, but that's expensive and time-consuming. Another method, utilizing a jet stream of water to cut the ditch, has proved very successful, but it, too, is costly. In both these operations, divers must go below to see that the line falls into the hole properly.

Welder Box was mulling over the problem of how to bury pipe more economically when the plow idea came to him one summer night.

"I got out of bed," he says, recalling the 1952 incident vividly, "and sketched the thing on paper. It looked almost too simple—the pipe threading through the plow, which would lay back the soil as it moves. I stayed up most of that night dickering with ways to make it work. Next night I stayed up again—trying to figure reasons why the thing *wouldn't* work. I couldn't find any."

With a go-ahead from I. D. (Slim) Wafer, superintendent of the Grand Isle District, Box set to work and within a week the first plow was off his one-man production line. Since that time, Box has improved and enlarged the plow twice. The latest, built of three-eighths inch steel plate and costing $900, weighs a thousand pounds and measures four by four feet. It's so awesome that its designer says "a mule would keel over dead at the mere sight of the thing."

Luckily for mules in lower Louisiana, the plow is pulled by a tugboat and two 100-foot barges. The tug is hitched to a front (or spud) barge carrying a crane and a winch. Connected to the spud barge by a cable from the winch is the back (or lay) barge. The plow itself, attached to the lay barge by



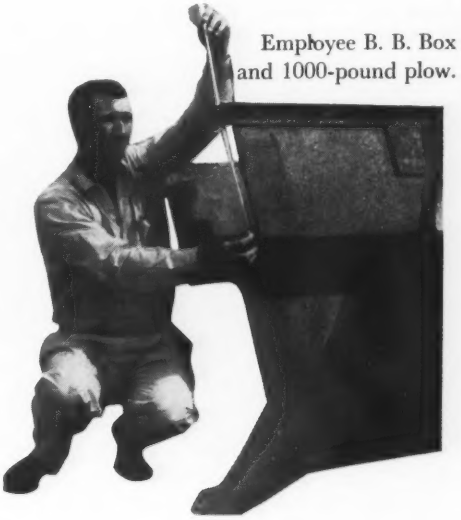
assembled on the lay barge and fed into the trench through the roller box or "collar" atop the plow.

The operation proceeds somewhat like a caterpillar crawls, one section at a time. The tug pulls the spud barge forward a short distance, leaving the lay barge stationary. Then the spud barge reels in the lay barge and the attached plow. Thus the plow, through the repetition of this series of steps, cuts a shallow ditch in the bay floor and lays the pipe neatly into it.

gned by Humble employee . . .

ER TOO WET TO PLOW

Huge underwater 'middlebuster' buries pipe line quickly and efficiently in shallow bays, brings its developer Coin-Your-Ideas award.



Employee B. B. Box and 1000-pound plow.

guide cables, trails it by about twenty feet during operation. (For complete description of the plow at work, see diagram above.)

The plow point furrows three to four feet beneath the natural surface and although it will not pass through hard rock formations or large stumps, it penetrates shell and uproots small stumps. As the plow moves forward, the pipe lowers itself neatly into the ditch—the only place for it to go.

Plow-designer Box estimates that tide action covers the pipe in the ditch in a month or so, but he's built another contraption to take care of the job in case it doesn't. Untested as yet, it's a V-shaped double scoop that would follow the plow by about forty feet and drag the soil back into the ditch over the pipe. "Kind of a plow in reverse," says Box.

The final job puts the pipe line out of reach of hungry little sea animals and normal corrosion. And it's deep enough to prevent freezing. Should the pipe ever need to be uncovered for repair or replacement, it can be plowed *up* just as it was plowed *under*.

Thus far the plow has been used on three jobs—once at Grand Isle and twice in the Bayou Sale District. Typical was a 1954 job in the latter, where 35,000 feet of four-inch gas line was buried three feet beneath the natural mud bottom (about ten feet) of East Cote Blanche Bay, south of Morgan City, Louisiana. The complete operation required only two days and saved the Company considerable money, according to estimates.

The big plow has its limitations, of course. Designed for use in shallow water, it probably would not be adaptable for the burying of pipe lines in deeper Gulf of Mexico waters. In addition, the operating costs are considerably higher when burying existing line (the East Cote job described above was a *new* line). Small criss-crossing "spaghetti" lines slow the pace. And the old line to be buried, when severely crooked and bent by tide action and dredging, is difficult to follow.

Looking at the "Bay Buster" resting on the barge deck, you reason that its developer, sinewy as the village blacksmith, was once a man of the soil—one who spent countless hours guiding a similar but much smaller plow up and down, maybe, the red hills of East Texas. That, you figure, is where Box got the idea for his amazing plow.

But you're wrong. Box's first job came during the Mexia oil boom of 1921. "It was selling newspapers in the oil fields," he explains; "Never plowed a day in my life—except with the 'monster' there."

R. B. Roaper Retires after 31 Years Service

R. B. Roaper

R. B. Roaper, one of the pioneers of industrial safety, retired September 18 after 31 years of service with Humble. He was Chief Safety Engineer for 27 years, supervising an extensive safety program.

When Mr. Roaper started the Company's first safety program to combat industrial accidents in 1929, Humble had a frequency rate of 43 disabling accidents per million work hours. In contrast to that mark, Humble's frequency rate so far this year is 2.15 disabling accidents per million work hours.

Mr. Roaper is one of the founders of the Texas Safety Association and a long-standing member of the American Society of Safety Engineers and the National Safety Council. He served as president of the TSA several times and as chairman or member of many committees for the two national organizations.

The American Petroleum Institute presented a Certificate of Appreciation to Mr. Roaper last year for his contributions to the field of industrial safety. He was honored also by being chosen to represent the state of Texas at the President's Highway Conferences in Washington and Miami.

A. Ross Rommel

A. Ross Rommel New Chief Safety Engineer

A. Ross Rommel has been promoted to Chief Safety Engineer of Humble Oil & Refining Company following the recent retirement of R. B. Roaper.

The new head of Humble's Safety Division joined the Company in 1935 after graduating from the University of Virginia with a BS degree in chemistry. He has worked in oil field drilling crews on Company rigs in Texas and Louisiana, as a chemical, petroleum and field safety engineer and as an Assistant Employee Relations Manager before becoming Assistant Chief Safety Engineer in 1947.

Mr. Rommel is first vice president of the Texas Safety Association, is active in the petroleum section of the National Safety Council and American Petroleum Institute Safety Committee and was member of the National Executive Committee of the American Society of Safety Engineers and member of the executive board of the Southern Safety Conference.

J. U. Parker, former Supervising Safety Engineer with Humble, replaces Mr. Rommel as Assistant Chief Safety Engineer.

Humble to Grant Graduate Fellowships

Twenty graduate students at nine U. S. colleges will receive fellowships sponsored by Humble Oil & Refining Company during the 1956-57 school year. The Company has awarded similar fellowships for nine years.

The grants, which total $41,000, will enable the selected students to do graduate work in geology; chemistry; accounting; physics; law; and petroleum, chemical, civil and mechanical engineering.

Schools at which the fellowships will be awarded are The Rice Institute, The University of Texas, Texas A&M College, The University of Oklahoma, Louisiana State University, Georgia Institute of Technology, The University of California at Los Angeles, Alabama Polytechnic Institute and Massachusetts Institute of Technology.

New Humble Building Opened in McCamey

A new, air conditioned Humble Pipe Line Company Office Building has been opened recently in McCamey.

The building houses the executive and staff office personnel for the McCamey District and is headquarters for an area extending from Crane to Fredericksburg and comprising 27 counties.

It contains 5,644 square feet and has 17 offices and a large conference room.

The first Humble Office Building in McCamey was built in 1926 of adobe bricks made on the site and stood on the same location now occupied by the new structure.

Society Honors Research Specialist

C. T. Shewell, research specialist at Baytown Refinery, has been elected a Fellow of the American Society for Quality Control by the board of directors of that organization.

This is a mark of distinction reserved for members whose accomplishments merit special recognition. There are about 9,500 members of the Society, 203 of which are Fellows. Shewell has been active in the South Texas Section of ASQC for several years, having served on several committees, and as section director and district councilor.

New Unit Scheduled at Refinery

Construction of a new unit—Hydrodesulfurization Unit No. 1—is scheduled to begin soon at Baytown Refinery.

This latest addition to the Refinery will be located directly east of No. 2 Hydroformer and will be designed to remove sulfur from light crude naphtha feed stocks used in hydroforming operations.

Removal of the sulfur from these streams will enable the Hydroforming Units to operate more efficiently by eliminating hydrogen sulfide corrosion, which in turn will extend the service life of the units. Increased hydroforming yields and more efficient utilization of tetraethyl lead in high octane gasoline also will be made possible by the new unit.

The facilities are scheduled for completion about November 15, 1957.

40 Years with Humble

Barney L. Ward, general foreman at Baytown Refinery completed forty years of service on September 14.

H. W. Ferguson Heads United Fund Drive

H. W. Ferguson, Humble Director and Vice President, greets three residents of the DePelchin Faith Home, a United Fund agency, before opening the Fund's 1957 campaign drive in Houston and Harris County on September 26. Mr. Ferguson is chairman of the UF drive in the Houston area this year.

Recent Retirements

HUMBLE PIPE LINE COMPANY

Name	Location	Date of Retirement	Years of Service
Byron Allen	Communications & Electrical—Houston	October 19	20
Clifton H. Dennis	Hearne Station	Sept. 26	28
Charles Gage	Longview	Sept. 1	29
Oscar B Johnson	Viola Station	August 25	22
Francis C. Mullins	Hearne Station	October 14	28
Roy A. Needles	Pierce Junction	October 1	36
Robert Pohl	Gladewater Station	Sept. 9	32
Thomas D. Rusk	McCamey Station	October 4	28
Fielden J. White	Baytown Products Terminal	Sept. 15	36

PRODUCTION DEPARTMENT

Bryan S. Culpepper	Jourdanton Gas Plant	Sept. 1	34
Robert S. Dewey	Midland	October 11	30
John D. Kennedy	Tomball	Sept. 6	26
Henry A. Kroeger	Paradis	August 27	25
Jessie D. Sims	London	August 27	26
Elbert J. Smith	Pickton	Sept. 17	22

BAYTOWN REFINERY

William L. Bailey	Machinist Dept.	October 1	35
Robert R. Bains	Mechanical Dept.	October 8	29
Thomas E. Ball	Carpenters Dept.	October 15	37
Charles F. C. Baumbach	Pipe Department	Sept. 10	33
Thomas J. Bolieu	Cracking Coils	Sept. 2	31
Arthur M. Edwards	Boilermarker Dept.	Sept. 14	34
David V. Gillespie	Service Laboratory	August 11	28
Robert E. Lee Hart	Pipe Department	August 29	26
John W. Lovli	Senior Engineer	August 24	32
Henry A. Matthews	Pipe Department	Sept. 3	31
Charles C. Shoemaker	Plant Protection	October 4	31
Gordon M. Strickland	Pipe Department	Sept. 18	30
Jake Stured	Machinist Dept.	August 25	25
Nathan L. Wilkins	Boilermaker Dept	Sept. 27	34

HOUSTON OFFICE

Rex G. Baker	Law Department	August 29	36
Andrew W. Malsch	Refining Accounting	Sept. 9	36
Robert B. Roaper	Safety Division	Sept. 18	31
Carl S. Sederholm	Treasury Dept.	October 10	37
Henry W. White	Building Maintenance	Sept. 23	28

Deaths

Employees: Travis R. Allison, 41, district petroleum engineer at Imogene, on September 20; Irvin A. Brunkenhoefer, 46, assistant division chief clerk in North Texas, on September 18; Thelmer A. Buchanan, 46, field gauger at Pampa, on September 3; Charles H. Carlisle, 47, staff geophysicist in Geophysics Research in Houston, on August 12; John D. Edgar, 45, rotary engineman at Means, on September 18; Lionel G. Griffin, 49, senior clerk in Crude Oil Operating in the Houston Office, on August 8.

Willie E. Harris, 51, roustabout gangpusher at Anahuac, on September 17; Jimmie Johnson, 48, laborer special at Baytown Refinery, on August 4; John W. Maxwell, Jr., 51, telephone and telegraph equipment foreman in Communications and Electrical in the Houston Office, on August 25; William D. Robinette, 51, tool pusher at Paradis, on September 19; William H. Sirls, 34, laborer at Baytown Refinery, on August 1; Shellie M. Talton, 61, district electrical foreman at Wink, on September 7.

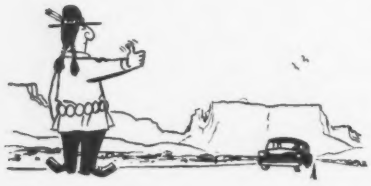
Annuitants

Cyril P. Blanchard, 58, former pipefitter first at Baytown Refinery, on September 11; Daniel R. Eason, 76, former lease pumper-gauger at Goose Creek, on August 13; Emzie T. Eldridge, 76, former janitor at Baytown Refinery, on September 24; Ray C. Hilbert, 64, former witness gauger at Gladewater, on August 29; Luther S. Peterson, 63, former helper at Baytown Refinery, on August 9; Albert O. Reeves, 63, former field clerk at Baytown Refinery, on September 9; Robert Roberts, 73, former general foreman at Baytown Refinery, on September 25; Jose Trevino, 65, former laborer at Baytown Refinery, on July 27.

Behind this issue

● Not all communication troubles in New Mexico (pages 22-23) relate to distance and rugged country. Russell Lilly, superintendent of Humble's Farmington District, found some of them at close range—no farther away, in fact, than riders in the front seat of his car.

Indians, Lilly discovered, love to hitch rides. And Lilly soon established himself, while he made his rounds, as



a friend of the footsore Navajo. But when the friendly superintendent tried to strike up a conversation, his guests conformed closely to their race's reputation for silence. He couldn't even get a traditional "Ugh!" out of them.

Falling back on a sure-fire formula, Lilly began to stuff his pockets with different kinds of candy bars. When the next Navajo clambered aboard, Lilly told him he could have his choice of candy bars; all he had to do was name it. Lilly was full on target. With a wide grin, the Indian named his brand and tore into the candy with unconcealed relish.

From that time on, the sound barrier was broken.

● On seeing the Hueco Tanks (pages 19-21) for the first time, one ponders the question: Why call them *tanks?* From afar, the place appears to be nothing but a giant rockpile.

Explore at close range among the rocks, and the answer begins to come. Well hidden at ground level among rugged formations are sizeable tanks, or ponds, filled with rain water. Smaller pools can be found tucked away higher among the cliffs and crags. Some waterholes stand far back at the dark end of caves or rock shelters. These, fed by rain trickling down from above, served Indians well during time of peril.

Weather changes rapidly and without warning around the place. On the morning a HUMBLE WAY writer and photographer visited there, rain seemed to be the last thing that could possibly happen. But late the same day, dark clouds swept suddenly across the nearby Hueco Mountains and thunder-bursts rang like artillery across the peaks. In a matter of minutes, rain began to fall in heavy sheets.

Out on the greasewood plains, parched ground absorbed the rain in thirsty gulps. But high among the rocks, the Hueco Tanks caught and held water that would remain for weeks—perhaps months—until it evaporated or until another rainstorm came this way.

● Around Humble's Bayou Sale (pronounced *sally*) camp, everybody knew B. B. Box even before he threw the big barbecue with the money he won for designing the underwater plow described on pages 24-25.

A native Texan, he's fast on the drawl with a good yarn and wears the deserved reputation of an idea man. In fact, the big (6-4, 195 pounds) welding supervisor had submitted three other Coin-Your-Ideas before he hit paydirt with the plow. Box's off-the-job gadgets include a trot line reel he's found handy on numerous fishing trips.

● The press boxes pictured on pages 5-7 are lavish indeed in contrast to the accommodations available to early-day sports announcers. Many broadcasts were made in the open as wind and rain whistled past the microphone.

The 1934 Rice-Texas game in Houston gave birth to Humble broadcasts, now in their 23rd year. Rice's band-box stadium had sold out quickly and the public clamored for a radio broadcast of the game. With Humble's help, they got it. No, Kern Tips didn't do the play-by-play account of that first game. But he was the public address announcer on that historic Saturday.

The Humble Way

Vol. XII No. 3

September-October

1956

Ribbons of Black Across the Nation.. 1
Football at Your Fingertips..... 5
Rex G. Baker Retires..... 8
Nelson Jones New Director and General Counsel 9
Dillard W. Baker New General Attorney 9
Working with Humble—Seismic Party at Work in West Texas.....10
Oysters and Oil (Part II of two-part article) 11
The Hueco Tanks.....19
Indian Paintings on Rock.....20
Keeping in Touch in the Hinterland..22
It's Never Too Wet to Plow.....24
By the Way.....26

Published every other month for employees and stockholders

HUMBLE OIL & REFINING COMPANY

P. O. Box 2180, HOUSTON, TEXAS

BOARD OF DIRECTORS

J. A. NEATH, *Chairman*

HINES H. BAKER — HERMAN P. PRESSLER
MORGAN J. DAVIS — RALPH J. SCHILTHUIS
H. W. FERGUSON — RAY H. HORTON
C. E. REISTLE, JR. — ED J. HAMNER
RICHARD J. GONZALEZ — NELSON JONES

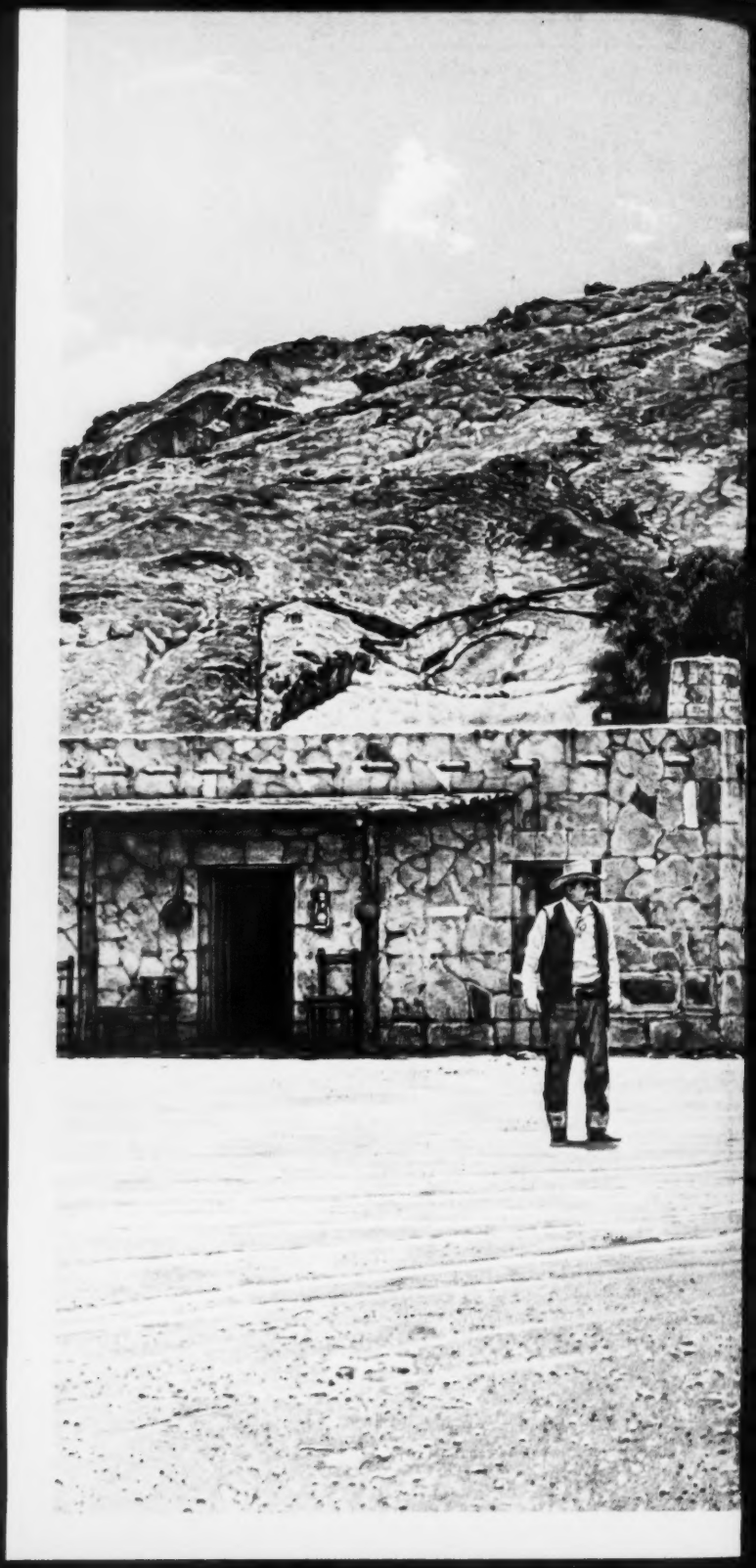
OFFICERS

HINES H. BAKER, *President*
J. A. NEATH, *Chairman of the Board*
MORGAN J. DAVIS, *Executive Vice President*
H. W. FERGUSON, *Vice President*
C. E. REISTLE, JR., *Vice President*
RICHARD J. GONZALEZ, *Treasurer*
NELSON JONES, *General Counsel*
O. L. LUPER, *Controller*
H. K. ARNOLD, *Secretary*

Art Credits: Cover painting by Bob Wygant; sketches on pages 11, 13, 15, 16 by E. M. Schiwetz; all other art by Harris Goode & Associates.

Photo Credits: Inside front and back covers, pages 3 (top), 4, 19-23 by Mel Coston; pages 5-7, 9 (top), 24, 25 (except center) by Tommy Nowlin; pages 8, 9 (bottom) by Johnny White; page 10 by Bill Toler; page 2 (top) courtesy The Asphalt Institute; pages 2-3 (across bottom) by Tito Zamora, except lower right by Glenn Cisco; page 25 (center) by Gus Behling; page 27 by Keith Hawkins, Houston Post.

Engineers and roadbuilders today still look to asphalt as their principal material. About four out of every five miles of paved roads in U. S. are built with asphalt.



The Cover Painting

Here, Artist Bob Wygant presents his version of a Butterfield Overland Mail stagecoach stopping in the late 1850's at the Hueco Tanks, some 30 miles east of El Paso. With careful regard for details, Wygant reconstructed the building and corrals as accurately as he could from ruins which still stand.

For more details on the Hueco Tanks themselves, and for an illustrated account of Indian pictographs painted on the rocks there, see story inside.